PATENT SPECIFICATION (11) 1 208 293

DRAWINGS ATTACHED

(21) Application No. 48298/67 (22) Filed 24 Oct. 1967
(31) Convention Application No. 13174 (32) Filed 27 Oct. 1966 in
(33) Australia (AU)
(31) Convention Application No. 19879 (32) Filed 4 April 1967 in
(33) Australia (AU)
(45) Complete Specification published 14 Oct. 1970
(51) International Classification D 02 j 1/00
(52) Index at acceptance
D1F X
A4K 2C2B 2C2X 2C3
D1T 2B10 2B1A1 2B5

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(54) THE FORMING OF SPIRALLED OR TWISTED SYNTHETIC PLASTIC FIBRES

(71) We, FILAMENT EXTRUDERS PTY. LIMITED. a Company incorporated in the State of Victoria, Australia, of 522 Little Collins Street, Melbourne, the State of Victoria, Australia, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the forming of spiralled or twisted synthetic plastic fibres, and in particular, the invention provides spiralled or twisted plastic fibres suitable for use in brooms, brushes, sweepers and the like.

It is known to provide synthetic fibres for the aforementioned uses, in the form of straight non-twisted fibres or crimped fibres. It is known to mount these fibres in the sweeper head of a road sweeping machine, wherein the sweeper head comprises a cylindrical wooden drum provided with a spiral groove extending over its length. The fibres are doubled at their centres and held to the drum by a rope wound into the groove through the folded fibres.

In another form, the fibres are clamped between a pair of steel plates so that they extend radially from the centre.

In the case of yard brooms, brushes and the like, the fibres may be tufted into the broom or brush head in the known manner.

A problem that arises in the known form of the fibres is that, when subjected to stresses, strains and temperature changes in use, the fibres tend to splay and spread. This effect is due to a memory function possesed by the synthetic plastic whereby the original curl which was impressed on it when the material was originally stored in rolls in filamentary form, tends to return to the fibres, notwithstanding subsequent processing and mounting of the fibres.

A further disadvantage which has been found in the use of the known sweeper heads, particularly when mounted in street sweeping machines, is that the straight fibres are not inherently resilient in the direction of their length, so that the sweeper head tends to bounce and be deflected by any uneven parts of the surfaces being swept.

In an attempt to overcome this, it is known to crimp the fibres in order to provide some longitudinal resilience, but the beneficial effect of such crimping is limited particularly in regard to subsequent splaying curving or bending in use.

It is an object of the present invention to provide synthetic plastic fibres which will be more resilient and wherein splaying, curving or bending of the mounted fibres, in use, is prevented.

It is a further object of this invention to provide synthetic plastic fibres for a sweeper head which as a result will have a longer wearing life in that longer fibres are provided for the same radius or depth of sweeper head.

It is a still further object of the invention to provide a method of producing such spiralled or twisted synthetic plastic fibres.

According to one aspect of this invention a method of forming twisted plastic fibres comprises twisting together at least a pair of synthetic plastic filaments by a twist imparting means in such a manner that each filament is twisted about the other or other filaments and that each filament has a spiral or twist formed therein, heating the so twisted filaments, cooling the heated filaments and thereafter cutting the filaments into fibres.

The twist force may be imparted by a rotating cage on which the filaments are stored on reels rotatable about axes transverse to the axis of rotation of the cage, the filaments being drawn from the rotating cage in adjacent relationship through a guide tube, die or rollers before entering the

[*Price 5s. 0d. (25p)*]

heating means. Alternatively, if it is desired to prevent the twist forming back onto the storage reels, a further rotatable cage is provided wherein the filaments passing from the storage reels are led over two pairs of pulleys or rollers rotatable about axes transverse to the axis of the cages. This further cage may be attached to the storage cage for rotation therewith.

The twisted filaments may be divided into at least a pair of separate plastic fibres, each having a spiral or twist formed therein, either prior to being cut to length, or subsequently thereto.

According to another aspect of the invention a method of forming twisted plastic fibres comprises twisting a single synthetic plastic filament about its own longitudinal axis by a twist imparting means, heating the so twisted filament to stabilise the filament in the twisted condition, cooling the heated filament and thereafter cutting the filament into fibres.

The invention also consists in synthetic plastic fibres or filaments formed by the methods in spiralled and/or twisted configuration, for use in brooms, brushes, sweepers and the like.

The invention further provides an apparatus for forming twisted plastic fibres from at least one synthetic plastic filament comprising twist imparting means, heating means for stabilising the twisted filament or filaments, cooling means for cooling the stabilised twisted filament or filaments and means for cutting the stabilised twisted filament or filaments into predetermined lengths.

The invention will now be described, by way of example, with reference to the accompanying drawings in which :—

Figure 1 illustrates a layout of an arrangement for carrying out the method of the invention;

Figure 2 is another view of the storage cage of Figure 1;

Figure 3 illustrates a part of the arrangement of Figure 1 showing the twist imparting means as an additional part of the storage cage;

Figure 4 is another view of the twist imparting means of Figure 3;

Figure 5 illustrates a length of a pair of twisted filaments; and

Figure 6 illustrates schematically a length of a single twisted filament.

Referring to the drawings, the synthetic plastic fibre material 5 is stored on reels 6 freely rotatable in a cage 7 having journals 8 and 9 mounted in bearings 10, said cage being rotatably driven by motor means 11 through a chain 12 and sprockets or the like driving means. The filaments 5 may be of polypropylene, high density polyethylene, polystyrene, Terylene or nylon, and may be of round, oval, flat or other suitable cross-section (" Terylene " is a Registered Trade Mark).

The filaments 5 pass from storage reels 6 through journal 8 which is provided with a passageway 13 acting as a guide tube or die. Rotation of cage 7 twists the pair of filaments around each other and rollers 16 draw the twisted filaments through a heating means 14 wherein the twist is thermoset and stabilised in the filaments and then through a cooling means 15. Cutter 17 operates to cut the cooled stabilised twisted filaments 19 into predetermined lengths which are collected for subsequent bundling in container 18.

Although the twisting of the filaments 5 together normally takes place in or adjacent passageway 13, the twist may in some cases be carried back to reels 6. This is not altogether detrimental but to obviate the carry back of the twist, a further cage 23 may be attached to journal 8 as shown in Figures 3 and 4. This cage 23 is provided with two pairs of freely rotating rollers or pulleys 21 and 22 over which the separate filaments 5 are led thereby ensuring that the twist cannot be carried back even through cage 23.

If it is desired to separate the pair of twisted filaments 19 into separate twisted and spiral filaments, a separating stage may be incorporated in the arrangement of Figure 1 either before cutting or after cutting. Any conventional separating means may be utilised.

Figure 6 illustrates schematically a single twisted filament 20, twisted about its axis as distinct from a twisted/spiral filament separated from a pair as above described. This filament 20 is formed by the same arrangement as in Figures 1 to 4 by using only one storage reel 6 at a time and using only one each of the pairs of rollers 21 and 22. By forming a single twisted heat stabilised filament 20 in this manner any tendency of the filament to curve, bend or splay in use is prevented. Whilst a short section of a length may tend to bend in one direction, the next adjacent section acts to cancel this bending and so on, and throughout the requisite length of the filament 20 in this stabilised twisted form any tendency to bend or curve is neutralised.

An alternative method of forming a single twisted filament comprises the steps of winding the twisted filaments separately on steel frames in a tight fashion, applying heat as by hot air, cooling the stabilised twisted filament for a short period and then cutting to the desired length.

The spiralled or twisted fibres or filaments formed by the methods of the invention, are particularly useful in the application to road sweepers, since the fibres or

filaments are readily secured to the sweeper head by any of the known means, and the twist or spiral effects a more secure attachment of the fibres or filaments to the head. Furthermore, the hitherto inherent defect whereby the known fibres or filaments become splayed curved or bent because of the memory retention properties of the plastic, is overcome, since the inherent curl of the fibre or filament is absorbed in each spiral turn or twist imparted to the plastic fibres or filaments. Consequently, the overall curl is compensated and the fibres or filaments remain straight under the conditions of use.

WHAT WE CLAIM IS:—

1. A method of forming twisted plastic fibres comprising twisting together at least a pair of synthetic plastic filaments by a twist imparting means in such a manner that each filament is twisted about the other or other filaments and that each filament has a spiral or twist formed therein, heating the so twisted filaments, cooling the heated filaments and thereafter cutting the filaments into fibres.

2. A method according to claim 1 wherein the twist imparting means comprise a rotatable cage on which the filaments are stored on reels rotatable about axes transverse to the axis of rotation of the cage.

3. A method according to claim 2 wherein the filaments are drawn from the reels on the rotatable cage in adjacent relationship through a guide member and pass in

4. A method according to claim 3 wherein the guide member comprises a hollow journal of said cage.

5. A method according to claim 4 wherein a further rotatable cage is attached to said hollow journal, said further cage having two pairs of rollers rotatably mounted thereon on axes transverse to the axis of rotation of said further cage and the filaments passing from the rotatable cage are led over the pairs of pulleys and the twist is imparted in said filaments between said further cage and the heating means.

6. A method according to any one of the preceding claims wherein the stabilised twisted filaments are separated to provide single twisted fibres.

7. A method of forming twisted plastic fibres comprising twisting a single synthetic plastic filament about its own longitudinal axis by a twist imparting means, heating the so twisted filament to stabilise the filament in the twisted condition, cooling the heated filament and thereafter cutting the filament into fibres.

8. A method according to claim 7 wherein the twist imparting means comprises a rotatable cage including at least one reel rotatable about an axis transverse to the axis of rotation of the cage for storing the filament.

9. Apparatus for forming twisted plastic fibres from at least one synthetic plastic filament comprising twist imparting means, heating means for stabilising the twisted filament or filaments, cooling means for cooling the stabilised twisted filament or filaments and means for cutting the stabilised twisted filament or filaments into predetermined lengths.

10. Apparatus according to claim 9 wherein said twist imparting means comprise a rotable cage on which the filaments are stored on reels rotatable about axes transverse to the axis of rotation of the cage.

11. Apparatus according to claim 10 wherein a filament guide member is located between the storage reels and the heat stabilising means.

12. Apparatus according to claim 11 wherein the guide member comprises a hollow journal of said cage.

13. Apparatus according to claim 12 including a further rotatable cage attached to said hollow journal, said further cage having two pairs of rollers rotatably mounted thereon on axes transverse to the axis of rotation of said further cage and around which the filaments pass from said storage reels before twist is applied.

14. Twisted plastic fibre formed according to the method or apparatus of any one of the preceding claims.

15. A method of forming twisted plastic fibres substantially as herein described with reference to the accompanying drawings.

16. Apparatus for forming twisted plastic fibres substantially as herein described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationary Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1970.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1,208,293 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

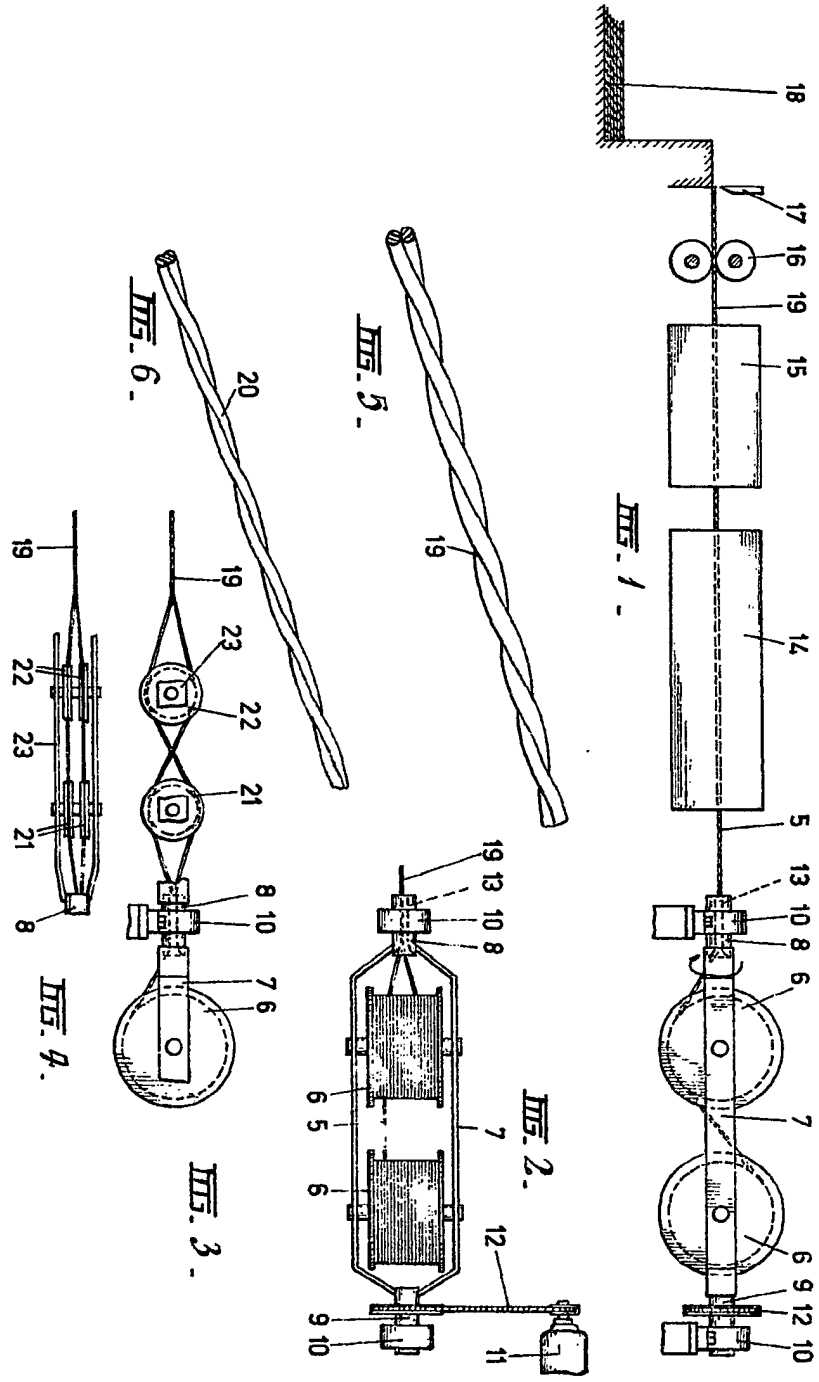

FIG. 1.

FIG. 2.

FIG. 5.

FIG. 3.

FIG. 4.

FIG. 6.